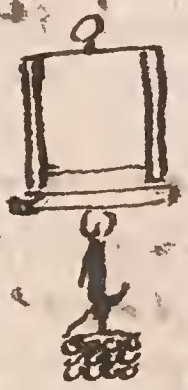
Magnoticall observations
20 Martij 1673

Concerninge the attraction of Iron or Steele

I had 4 good Loadstones
my largest stone in the form of a longe
square thi armed weighed — 9 ounces
with a little square barre of Iron and
a hooke in the middle in thi
forme vt.



It tooke up of brasse ounces 28 3/4 1/2
had it been an Iron anchor it
would have taken up much
more by reason of the direction
of the magnetick force to the
Extremity of the Iron anchor
whereof the brasse weights are
not capable

That end of the stone which lieth
to the South being placed in a cake
in a dish of water (viz. yet in deed
the true north end) had a farre
greater attractive power then the
other end which so placed moved
to the north

For the former end onely tooke
up six brasse ounces
the other end tooke up above
three ounces but not fower
ounces

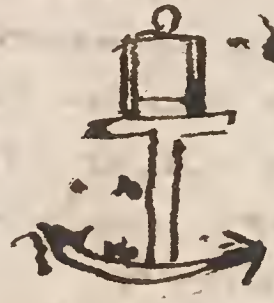
The libe dyfrauly of the stone attra
ctive strength appeared in the other
stones wth the end of pole turning
to the south (though in reality the
north end of the stone) had a farre
stronger attractive vertue then the
other pole or end who[se] so placed
turned to the north:

2 The next stone in bigness was
a Terrella or spherical stone
This armed weighed 2 —— 3 ounces
And took vpon it 4 ounces
And though this stone was a farre
nobler stone then the former and
was shaped and cut out of a stone
much of the weight and shape of
the former and before it was so
cut would take vp an Iron anker
of 12[lb] weight as I had often tryed
yet being so cut into this forme would
not Equall the 4 attractive power
of the next mentioned stone that
had not a third part of its substance
or weight
And the reason of this diminution
of its attractive power in no way
not only by the diminution of
its substance But Geometrically
from its not spherical forme
For in a square stone as the last
was and as this also was before
it was cut all the radij of the
virtual magnetica in the whole

South of the stone were directed
parallel to the horizon to all those
sides the whole side of each cap of steel
cameram ge the two poles and so were
by those steele caps directed perpendi
culerly to the barre of iron & sufferred
But when cullom that circular forme
the radij magnetici were moved strange
at the 2 poles but at those spheregatge
it selfe narrower and narrower every
way so those radij fell shorter and
shorter still as the stone sphere grew
narrower and narrower towards all
the segmente
So that though the directive power
remained as strange in the spherical
magnet yet that attractive power
grew thereby weaker in relation to
the weights it could elevate:
That point that turned southward were
wel the true north point wel not distin
guished from the other aukly enough
by a little breach or chap just in the
polar circle by this I know it the
former greate stone wel marked
N for that part that turned to the
south and so known

3 My choice stone set in gold bongo
almost of an ovall figure weighed bongo
armed weighed 2 3/4 of an oz 7
ounce:
4 I took up an of brasse weights
bongo apted by a little brasse bare

of Iron a hooke and brasse anuor
appended to the hooke 9 anuor
Just hanged on Iron anchor of
about Just 12 anuor ot the
Iohime hor under hor. Thereon Hooke
vp that Iron anchor and 3 anuor
more wth together with the bells
annexed to 2 ——— 15 anuor

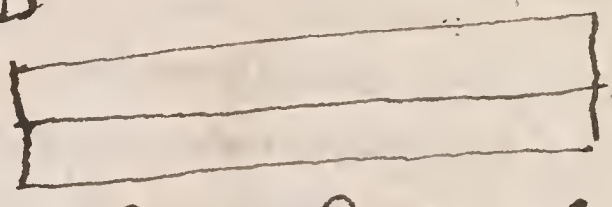


and by tryinge at in the first
stone the ends apart & I found
that the stone benige placed per
pendicularly upon a plarbe that
swam on a bason of water that
pole that turned to the south had
a greater attractive and sufficient
power of weight then that wch
turned to the north as on the
first Instance the not true north
Cathatide the greater with the file
& my smallest stone was a frag
ment of that stone wherevnto my torrella was made
It was now a cylindrical forme
only a little flatt at each side
where the poles were
It weighed benige armed 1/4 of anuor
It tooke vp in brasse weights

hanged to a hook fastened in a
little wooden barrel in the first
figure 2 ——— 2 ounces $\frac{3}{4}$
and had it been a little Iron anchor
I believe it would have taken up 4 ounces
for the weight above given; But I
had not that Engin wherewithal to
all my ~~stones~~ magnetts and therefore
I am forced to make my Estimates
by the biggest weights
so my greatest stone weighing 9 ounces
tooke up 28 ounces $\frac{1}{2}$ which is more than
thrice his weight
my Corrolla tooke up but $\frac{1}{4}$ more
then his weight
my 3d magnett weighing $\frac{3}{4}$ of an
ounce tooke up 9 ounces which is
ward 12 tymes his weight
my last magnett weighing $\frac{1}{4}$ of
an ounce tooke up 2 ounces $\frac{3}{4}$ wch
is 11 tymes his weight:

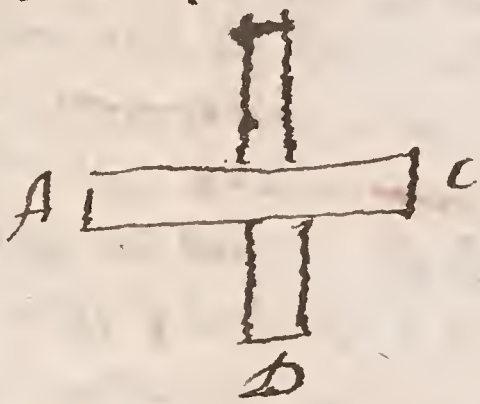
To shew the direction of the
the magnetic
Convey the attractive vertue
of one stone to another, and made
to another as the armated made
to the magnett:
If there be 2 magnets A and
B that pole of B that diverts it
self south will attract that pole
of A that diverts it self north

and Contrarywise
But that pole of A that diverts it
self north will fly from that
weaker and have away of the
stronger that pole of the stone B that
looks also north and that part of
the stone A that looks towards it
self to the south will fly from
and have away that pole of the
stone B that also turneth south
So the similar poles are at enmity
one with another and the dissi
milar or contrary poles unto
one another:
If the longe stone A B & D
whose north pole is A B and south
pole C D bee divided longways
parallel to the axis of the poles
as so that new A C becomes one
stone and B D another stone
as longe they lye in that parallel
position A C & B D will keepe
the same poles as before viz
A will bee the north pole of A B
B will become the north pole
of C D



But they and accordingly

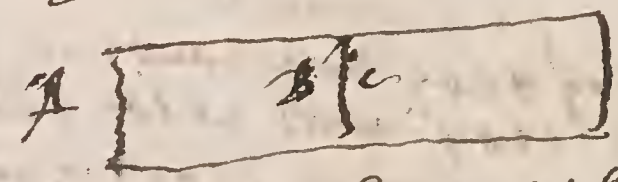
will continue quiet in that position
one upon another
But if they be severed from ranking
with they will alter their position
And so though their centrigrity
continue yet if they are layd
another their attraction will
give rise to B



For if gravity in a manner cut C
will turne about to B and A to
D and now their position will
bee as follow

which I have often by tryed with
a grave of the same bredth
But if the stones bee rounded
perpendicular to the Axis they
will still hold the same position
as they hold when they were
undermined

as for instance



If A be the north end of the stone A B C d and d the south end and it be directed perpendicularly upon the axis of the stone whereby A B be uppermost and stone and C d be nearest another A will the north end of B the south end of A B: and C will the be the north end of C d for they hold the same position as before in the stone when it was entyre
But if a B be laid upon the stone C d A will turne to D and B to C and so change their position the north pole of the one repulse from the same way with the south pole of the other & Enumerate:
As the poles attract of the stone attract their contrary poles and drive away their similar poles for poles So the contrary poles of the needle touched with the stone attract their contrary poles and fly and drive away their similar poles

pole of the
And so the needle that turnes
to the north bonigo touched is attra-
ted by that pole of the stone that
turnes south and is chased away
by that pole of the stone that
turnes north & so consequently that
pole of the needle that turnes south
is attracted by that pole of the stone
that turnes north and is chased away
by that pole of the stone that turnes
south:
pole
And the reason is by reason that
point of the needle that turnes
north must bee touched with that
pole of the stone that turns to ye
south and consequently that point of
the needle where is touched with
that pole of the stone that turnes
north to ye north will turne to
the south:
And hence it is truely concluded
that the pole of the stone
with bonigo left upon a corke
or on a wooden dish to
swim freely upon a cuppe of
water to turneth to the south
is mistruth the north pole of the
stone and according by they
are always at this day
marked and so are my magnets
marked though heretofore by
they thought that pole of the

wherby being thus left to float upon the water turned to the north was the north end of the stone: wherby wee is now certified

For the the [illegible] needle whose point is touched with that end of the stone that turneth south is that wherby turneth north and is the common diuision of the mariners card;

But though the point or pole of the needle touched with the stone go south end or pole that turneth north yet it is certaine that that north end of the needle so touched and now standeth northward will bee attracted by that vnd or pole of the magnet with where it was touched namely that end or pole of the magnet that turneth south and the other end that is touched with wherby turneth south will bee attracted by the pole of the magnet that touched it and turneth north and will bee chased away by the the other pole of the magnet that touched it not and turneth south

So that the amicitia betweene the point of the needle and the ~~so~~ pole of the magnet that touched it and gave it its direction touching needle: ~~but the~~ and the inimicitia betweene the pole of the magnet ~~that touched it~~ and the needle that was touched by the opposite pole of the magnet touching needle

And yet the amicitia betweene the north point of the needle and south pole of the magnet and ~~the~~ betweene the south point of the needle ~~magnet~~ & the north point of the Magnet continue

For it is the truth that giues the causalitie betweene the needle and the pole of the stone ~~not the~~ that giues the friendship betweene them through the line of direction of the one betweard the north and of the other betweard the south:

3 Touching the vertirall direction or the verticity of the magnet or magneticall needle:

That pole of the stone that turnes to the south (which yet is the true north pole of the magnet) Is proued both by sole & bolaw the

horizon and so stands & directed
to the southerne pole
And consequently that pole of
the stone that is directed south
northward elevated itself above
the horizon and the pole thereof
answereth to the north pole of
the heauen or earth and is elevated
aboue the horizon as many
degrees as the north pole is elevated
aboue the horizon:

Namely if the magnet bee
properly sphæricall and
left to swim upon a water
of ordinary waight will
beare it up and giue its
liberty to moue accordinge
to its due and naturall
direction

And so if a needle bee touched
with the south end of the magnet
and bee put through a
peece of corke bee left freely
to swim in the water the be
end touched with the north south
end of the magnet will turne
about to and from to the north
and will bee there elevated
aboue the water and the other
end depressed

depression
is aboue
the horizon
as much as
the pole is
elevated & is
south end
raised aboue
the horizon
as much as the
north is depressed
but where
answereth not the
same elevation for
the depression
is greater
then the pole
elevation viz
at an Elevation
of 52 degrees
the
needle depres-
seth to 70
& raised as
much in the
south

And the Elevation of the north end will in an mathematy needle directly answere the Elevation of the ~~pole~~ north ~~pole~~ and consequently the other depressed end of the needle will answere to the south pole of the Earth or world

Now I shal figure the reason of these phenomena:

1 It is to bee noted that the Earth is a great magnetical body & hath its two poles ~~of~~ the north and south poles and whether the Earth move or stand still as to the consideration of its magnetique vertue materiall:

2 The Equate of the Earth is that imaginary line that deuides the Earth into two equal parts or hemisphere the one respecting the north and that is the north ~~Hemisphere~~ the other respecting the south pole which is the south Hemisphere

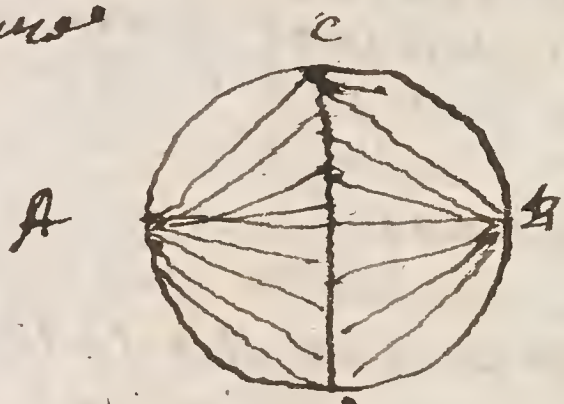
3 The ~~imaginary~~ ~~streat~~ line that ~~round~~ Earth consequently hath its two imaginary poles the north pole in the middle of the ~~super~~ round superficies of the north Hemisphere and the south pole in the middle of the round superficies of the south Hemisphere

4 That adioyned to all observations of former tymes the point in the

the heaven that is perpendicular to the north pole of the Earth is that we see equally all the polar starrs are very neare it
The imaginary line that runs straight from the north pole of the Earth to the south pole is through the center of the Earth is that we call the axis terrestris or axis totorum terrestrium:
The imaginary parabel line drawn from Earth pole to the the other in the centrum convex superficies of the Earth and cutting the Equator at right angles is that which we call the Meridian line
The Horizon is that Hemisphere of the Earth that deuideth from the appointed Hemisphere or half of the terrestriall globe which hath for its middle or zenith the point or place whereon for the purpose for any other man or thinge stands or is fixed we
zenith or middle point is always in the middest of that half of the meridian circle which terminates or horizon but more lesse more or lesse of the Equator accordinge to the remotenes and or neerenes that that artificiall point hath relation thereunto

7 The distance of the middle point
of any horizon from the Equator
of the Earth is that which is called
the Latitude of the place which
is measured by that Elevation that
the pole hath in that middle point
of the horizon And if the Latitude
or distance from the Equate bee
of the South side of the Equate
it is called Southern Latitude if of
the north side of the Equate it is
the northern Latitude:
8 Therefor the Latitude wherein wee
live at this place is 52 degrees
of northern Latitude for so much
the northern pole is Elevated
above ye horizon
9 The magnetisme as well diurnal
as attractive of the Earth is derived
from the Equate towards either
pole namely the magnetisme that
is derived to the South is derived
from the Equator or middle of the
South hemisphere towards the South
and from the Equator or middle of
the north hemisphere towards the
north
10 Although there are innumerable
points in the convex superficies of
either hemisphere according to the
magnetical Effluxes of the Earth
are thus directed yet the Streets

strongest Energy and apte of those
Vertues are ~~contained~~ drawn
from the whole substance of
Earth hemisphere to the pole
Except most of the lines of the
Vertues to be those nexte
and nerouter. according to the
figure.



wherin let A be the north pole
B the south pole and the center
axis betwen them A B: Let C D
be the Equate and the vertual lines
directed to A be the vertues of
magnetize directed to the north
pole and the lines drawn from
the intersection of the Equate
to B be the magnetical directions
to B namely to Earth from Eq
Every point of ~~Earth Hemisphere~~
the volume of Earth Hemisphere to
Ei respective pole:
The reason wherof must be
that the greatest vigor of magnetize
vertue of the Earth must be
concentred ni and their polar
points and from thence unto Effectuly
Equated:

11 As the Earth is a greate magnet
so a magnet is a little Earth and in
all its magnetical Energyes hath a
perfect conformity to the Earth
whose shilde as it were it is and in all
magnets all motions appearances and
phenomena strictly resemble it:
As the Earth hath its magnetical poles
so hath the magnet as the Earth hath
its Equate so hath the magnet all the
magnetical influence is diverted
from the plane of Each hemisphere
towards it poles and is most Efforts all
there so is the magnet As the Earth
hath his poles for instance East & West
seated in the of horizon 52 degrees
so hath the magnet (And if wee
could suppose the Earth did move
about its own axis) wee might reas-
onably suppose the magnet might
do so if it were not obstructed
by its own weight wch carryes it to
the middle of the earth as the roman
Center of gravity and stayes its
circulation (But of this hereafter)
And as the other side wee may argue
Examinate so that those phenomena
that were see in the magnet by aides
more obvious to observe then the
magnets all phenomena of the Earth
yet from those wee may argue
probably of Analogie for the like
Effects of the magnet true of the
Earth:

And this will open the reason of
so many phenomena also in the
magnet which would else otherwise
obscure and darke: For instance
how see in the magnet that the
if two magnets bee the north pole
of the stronger magnet will attract
to itself the south pole of the
weaker, and make it more and
more to it the like in magnetic
all needles:
And this seemes to bee the reason
why the true northend of the
iron driven by the south beyond
ouercomed by the more potent
magnetisme of the north pole
or appy borealis magnetisme of
the Earth
And the like would happen to the
true south pole were it in the
southern hemisphere
And yet it is observable amongst
that ~~pole of the magnet that turned~~
~~to the~~ that if a longe magnet
bee deuided ~~it~~ yea also in the ex
act of the magnet it is observe
thereon that the weaker or lesser
part should attract the other which
is stronger and ~~so~~ the lesser most
the upper will change its situation
and that ~~pole~~ thereof which was
formerly south will turne about
to that pole of the lower that
stands in north

Note the sharp end of the steel and that of the other near that is broken at one corner for the north end of both

And this shows why the true North pole of the Earth draws the south pole of the magnet and makes it point northward: namely the attraction of contrary poles on upon the other

But yet it is observable if a needle be touched with the north end of the stone B B needle be touched with the south end of the stone. The north A will turn to the south and B to the north But if the north end of A will attract the south end of B and chase away the other and have no power at all of the uniforme or similar pole

But yet the pole of the stone that touch A will attract the end it touched and chase away the adverse pole through the pole that touch B will attract the end it touched:

So the magnetisme of the two adverse poles in the stone attract one the other and likewise the magnetisme of the poles in the needle But it is the

the same pole that touched that
attracts the pole of the needle
which it touched: and the contrary
poles more and contrary

I take a fine sorbo & finally break
on the fore and then to sharpen
in the chimney end: and place
a small iron a bottle cruche
ferruginous in a vessel of
water the sorbo that usually
touched the ground burned
and stood directly north
but moved to a needle the
north end attracted not the
north end of the needle but
the south end:
yet it seemed the magnetic iron
that the sorbo obtained is by
its contiguity to the Earth in
the north from the northern
magnetism as if really touched
with the south pole of the
loadstone

But I do finde that the north side of
a lesse magnet contiguous to the
south side of a greater stone though it
have attracted thereby not the lesse
stone hath a lesse attractive power
but is reived to the north side & retained
if not more as doth its attraction

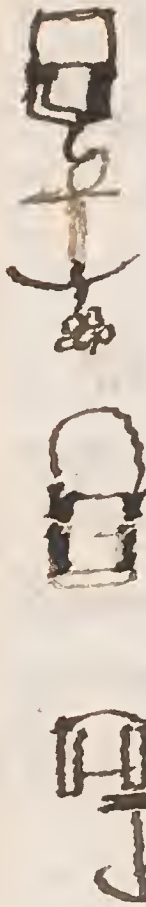
An Iron heate red soft and hold
over the north end of the stone
till cold attracted the point of
a needle touched with the south
End of the stone and chased away
the point of the needle touched with
the north End

Heate again and touched with the
south end of the stone attracted
the point of the needle touched with
the north and chased away the other

The certainty very Easily proved
But that north was towards the
south

and the like Easie apparant
certainty may be made that the
north when held over the
north end of the stone

The great stone with an Iron Engin adherenge to its armature in the forme in ye Margin: broke up 27 ounces the anchor weighinge 12 ounces ½ and an addition of weight of 15 ounces

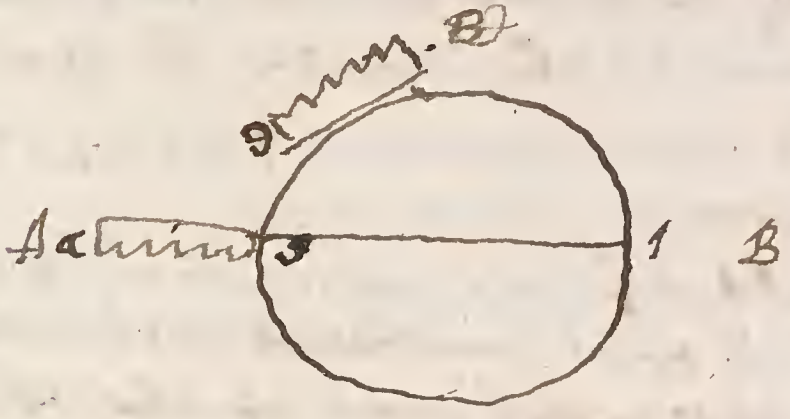


But with an Engin consisting of 2 Iron plates and a groove of wood joyninge them together broke up only the anchor and 1 one ounce and ½ the weight of the Engin:

which would be taken up by one of the Iron legges of the stone without the assistance of the other legges

because in this latter instance the groove of wood broke the anchoring between the two plates

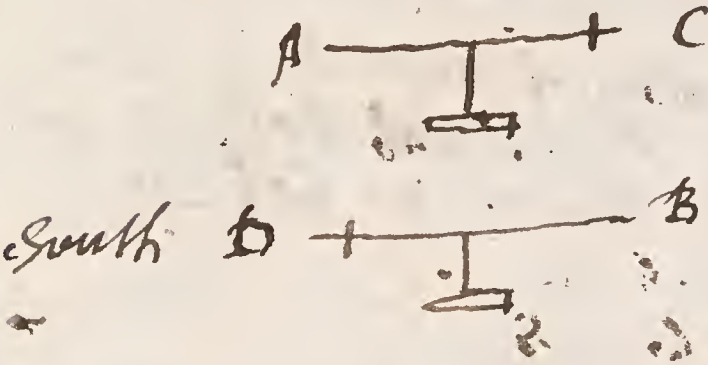
Note the reason why the south end of the stone turnes to the north is because the north pole of the Earth attracts ~~it the south~~ end to of the stone to it as poles among and if it could draw it to it would make it ~~towards~~ that south End to turne quite over and ~~turne~~ so its ~~face~~ so south face would turne to the south and the north face to the north for instance



suppose A were the north pole of the Earth B the south pole ~~&~~ D a longe load stone whose upper face was like a face for distinction sake D the south pole of the stone placed in its dorinatly position towards A the north pole of the Earth & the true north pole of the stone yet looking to the south and would be ~~ravisquant~~ elevated ~~at~~ as much as D is depressed if were would slide a longe D C to the true pole of the Earth D ~~the south true~~ the position would be quite changed for the ~~to~~ D the true south pole of the stone would be joined to the north pole of the Earth and so its ~~south~~ true south face would stand south and ~~&~~ the true north end would ~~stand~~ point to the true north.

stand it is but the same thing to do
for in a horrolla and a needle
prove of a lawdange needle
If the point of the needl bee heard
the true north of pole of the stone
pointeth to the south breuys
lefe freely to mane in a dish of water
let the point of the needle be marked
with the north point pole of the
stone upon It will stand upon the
north side of the meridian as the
his marked point bendeth towards
towards the north point of the stone
south point of the stone and mene
t onward it till it come to the south
pole it will turn ouer and stand perpend
vnder to with its north point against
the south pole and so it stands
points directly north as it aught to
do

now I touched the needle A with ye
north end of my stone this though
it would turn to the north End of
the stone yet left it a little pointed north: viz to C
But when I had touched
the needle B with ye
north end of the needle A
the needle A with the point so
touched pointed South to D



yet the points D & C would
come to gather and so would
A & B and D & A fly from
Each other

Every body remains in its state of rest or uniform motion in a straight line unless it is compelled to change that state by forces impressed upon it.

The needle touches stands north and south

At the north end of the stone and therefore is directed north

If a current flows south & north, of the magnet is accordingly directed in the bed and therefore if ever more attracts and repels the same position

north south

why if carried at right angles and does not go back as before

note al 11 gts departure from the magnet
the north Cuffis at midpoint placed by
the parallel to the Equator towards south
parallel to the axis of the stage
but the north pole turnings towardly
north the needle is turned south
the pole
of the Centre only stronger in the
ayis than in other place

Note if the point A of the needle AB
be touched with that part of the

B ⟵ ⟵ A

stone that turned to the south pole
is moved the the north pole of the stone
A with the axis of the magnet
that touched will turn to the pole
that touched it but out of the orb
it would will touch to it where
ever it is placed but out of that
orb it will touch to the north
and being turned to the
north pole of the pole that
touched it came near it it
will turn not

But my first probe the Ladder rod
will turn to the north placed freely
but will attract the south
end of the needle & not the

North and West

But a stronger would have Power
and if more probable what of
this was never placed Experi
ence evidently proves to us that
it would have South Longitud.
hath a South Face

2 As it should work a mad to
it seems it would give it
a South velocity and so
by Experience I found it
and the Point touched by
the Firebrand had a South
velocity ~~Cut out~~ and was
attracted by the said Vital
Magnet it left the Earth
more the Earth where moved
North But the said Earth moved Southe
that part where that was South
and was attracted by the
true ~~North~~ South of my magnet
Vital standeth ~~South~~ North and
driven away by the true
~~South~~ North and that standeth
~~South~~ North

The forbe suppraded m Egthebro
by the a stwrte the forbe and
plainly turned he the mouth and
there M Rested
But as I moued the Rud mouth
End of my staue that turneth
towarde the south it did Endeally
abrad – M Euery way Es yrosh
yreproued yd downewrd
But the Rude south of my staue
which turneth Northward did
not abrad but rather drawe
M from M

Mesa m a Jmal medle nor worthe
Lubes of by and Contrary
Lonth & giuen by another
y Se m mfinitum

A mere be we have had ~~both and~~
~~were Hearted by~~ the Rev Cassius
attracted

Now.

I ~~wrought~~ tried a longe greate Iron needle
of a foot & Inches longe with a turne
in the middle with the north end of my
stone (that turneth his face to the south)
and suspended it with a string
the End touched turned to the
north
and declined & dipped down
and attracted the south end
of another needle

Then with the north end of that
longe needle I touched an unburnt
small needle with at the Center and
by the many reiterated touches
the small needle gained a contrary
verticity for the Center the point
touched turned to the south and so
had a contrary face to the long
needle that touched as that
longe needle had a contrary face
to the stone that touched it
And now the south end or of the
small needle with the Center would
but attracted with the north end
of the longe needle that touched it
But not the definite ends attracted
and fastened each other

But the south end of the magnet attracted the south end of the small needle & the north end chased it away so that in that instance the similar poles were found united and the dissimilar ones found in mutual contrary to all former instances

A fire globe suspended ~~[illegible]~~ directs the tower and towards the north pole it approached those by the north pole of the Earth and hence we it not as it formerly by its own magnetism

But by approaching with the adamantine rather of that pole by each it was attracted

For it is plain the direction of the globe is in the same and as it were one of the axes of the Earth magnetism probably the northerly would [illegible]

Jet Jan
Ff

yet there are two strange things
in it

1 The forke that turned north
attracts the south end of a
needle magnetically touched

2 yet the forke be suspended or
attracted with either parte of
the stone but more forcibly
with the north be similar
parts attract similar because
an Iron Excited by the Earth
at the forke is and a magnet

and it runneth the south end of
the stone did draw more
Effectually upon the south
end of the forke then the north
end of the stone did through both
drew:

Whereby it seemes that the south
of the forke neyt the Earth obtains
a north verticity not properly
and of its own nature but by
it is so turned thither wards by
the power of the Earth
or rather (for whether the attraction
by the Earth be, by the magnet
I see not by different parts
or whether the inclination of the forke
from the Earth may be little in

Compasses of the ordinary by a magnet
that it would rather attracted as Iron &
not as Iron unmagnetised
Just as a needle unto which had Lapis ni ſ
Nature hath a Correct Polarity but
it so small that it is attracted by
either pole of the stone and almost
Equally & not from Septentrio to South
Septentrion!
And therefore Forke ni attracted almost
Equally by both poles though
stronger by the North pole upon
the North End with the Forke
If it a Large Needle before the
Forke would Compose it selfe to
the North it was at first 2 hours
before it was settled when suspended
by a thread: Whereas a needle
touched with a Magnet instantly
gaines & shewes its Polarity

12 Aug 1674

at 8 Inches distant from the Centre the needle to rest with the north end standing north would not change this needle to turn it to the ~~north~~ south towards the ~~point~~ pole that hinged it

But an Iron rod contiguous to the north end of the magnet between it and the needle would make it turn to it at 10 Inches distant from the magnet

A rod of Iron set to rest placed below the needle the upper End attracted the north End of the needle strongly and vigorously but placed perpendicularly perpendicularly above the needle forcibly attracted the south and ~~which end~~ ~~the End of the Iron rod was placed~~ ~~below~~

But if A B the iron rod

if A be placed above the perpendicular a N it ~~turns~~ attracts N and if B be placed as above it attracts S But if both the rod if will for turn by the hand one after other till it hath stood round upon

with A B bar placed under mark N
and A bar turned downward above

N:
It seems that the rod of Iron gets
a temporary virtuity from the
touched end of the versorium: &
whether it be the magnetism of
the Earth
and the same applyed parallel to
the horizon A that way the
upper end in the perpendicular
station attracts the north B the
lower end attracts the south and of
the versorium: when the application
is north & south / with in the
meridian
and through the Iron bar placed
in the Equator or parallel to it
yet they attract as before
but not so strongly as when
placed in the meridian

If I placed the Iron rod perpendicularly
under the pointed end of the versorium
touched with the south pole it
moved it not somewhat

attracted the north point to it
but placing it at the End of the Iron
perpendicularly over the south point
of the needle it attracted the south
point & would follow it in all positions

Take a needle whose cuspis is touched with the true north of the magnet viz that whose face is south.

Take the magnet and turne that ~~and~~ true north with its face northward vntill it an vmal real position at ☉ ☽ 6 nother distance it ~~from~~ the cuspis placed on the meridian would bee gouerned by the pole of the stone and turne its cuspis to the south but remoue it 6 ☽ nother further its own proper attractiy would conquer the attradian of the magnet and place it, ~~self~~ cuspis north:

If the stone bee placed in its true position viz the ~~north~~ true north with a south face the cuspis of a needle touched with that pole ~~north~~ on the south part of the magnetical meridian at ☉ 6 nother distance and turne it round to the west till it come to the ~~Meridian~~ Equinox it will still keepe the cuspis towards the south vnder the gouernment of the true ~~north~~ south face of the magnet and in that position it will stand in the Equinox but beinge carryed round in the same distance it will conuert the cuspis towards the north and ~~in the~~ when it comes to the meridian the cuspis will stand full north and as it is moued forward toward the East Equinox then pole the Crosse will stand inclininge to the north part of the stone and ~~be~~ when it comes to the Equinox the cuspis will stand south and the crosse will

will stand north: but
for in that distance the proper verticity
of the vorterium is under the aforesaid
gnomonic of those respective poles of the
stone:
But place the vorterium in the meridi-
an on the south side of the magnetal
& longer or more distance in the countrhan
of the needl round the stone towards the
west & the cuspis will still keep north
ward and in the Equath will stand
parallel to the axis with its cuspis to
the north and when it comes to the
meridian it will be directed full north
and as it is moved forward round the
magnet in the Equath still the cuspis
will in what north and stand full
north in the meridian Equath and as
it moves still on southward the
cuspis will always respond north tel
it come to the meridian and there
stand full north:
And the reason it hys assigned that
verticity discovers its the proper
verticity of the word is not conquer-
ed by the force of the stone
which touched them into a contrary
contrary to is drawn towards west it
full north:

I hurbed a longe rodd of Iron with the
north end pole of the stone: which ~~which~~ ~~Could~~
~~gruntly~~ whose face is south the Iron would
Cause gruntly ablome a north worticity I
then hurbed the cuppi of a small rodd
with that Iron and it the rodd
had thirdly a north worticity
I also hurbed the other End of the Iron
with the south pole of the stone that
standeth north and with that End of the
Iron he hurbed the Cruy of a small rodd
and it gained a south worticity
yet the north point of the and rodd
was attracted by the south of the
other And the Extremities and
also the south end of Each way
attracted by the north end of the
cuppi originally hurbed with the
north End of the magnet
and the north end of either of those
rodds then intermidiatly hurbed
was attracted by the ~~north~~ end true
north of the magnet that ~~was~~ whose
face is south.

I do find that in the admotion of the
Septentrion towards the magnet when it
stands on the Equate parallel to Egypt
the attraction of the south pole whose
force is worth in more exigerum and
contrapates the attraction of the north
syde whose force is south:

---

21 Aug 81

Touch a knife with the true south
of the magnet and with that knife
touch the end of a needle most infallibly
that end of the needle will have a
~~south~~ northerly
And touch a knife with the ~~south~~ true end
of the magnet and with that knife
touch a needle it infallibly that
end will have a north northerly
virtue. I rubbed several times
And the end that was touched
by the knife will be attracted
by the south

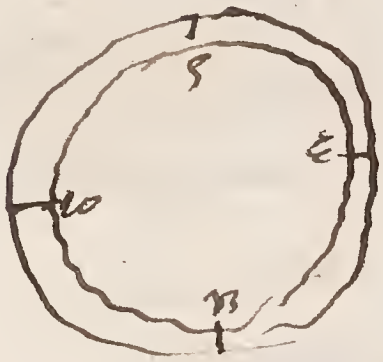
But the ~~north~~ point that touched by
the north will be attracted
by the true north of the magnet
& the other end shunned away

and ye contrary

and the needles are touched with
the one the other with the other
knife the point that we have an
appetite to which will know his Eare
to other & Enjamd

For the point of the knife
touching the true north
of the magnet giveth a
in truth a south variety
though it it selfe a needle
by the vigor of the Earth
it would turne to the north
and therefor when that
impregnate another needle
it in truth giveth it a north
vertuely though it have
south namely a vertue
contrary to it self

In a rouge of Iron



touches at ♋ with that pole that turneth
South affected at ♋ the ~~north~~ Cuspis
of the needle that turneth South
at ♑ the ~~cuspis~~ Crus of the needle that
turneth South

The pole

29 Aug

a magnet placed into 9 Dragmor of stools
dish in a box
Thro the quantity of stools during another
box
see what loss in weight by
continuance
what alteration in figure
weather rusty or not

are marked 4
marks 4

J Coppafer
Dragmor

a steel rod marked N at one [illegible]
of 2 foots longe and ~~with~~ in headed
rod both and sott with the N wod the
Earth hill is cached

1 N attracted the south end of an
armiated small needle & the
other end attracted the north pole
of that needle

2 but suspended magnetic ~~it would~~
the north N had no inclination
but a north northerly

3 neither end would mound a
small magnetic needle

4 either and seemed equally attracted
with the north pole of the
magnet

5 the iron magnetic first cooly
below and then above or upwardly
for the heate ~~of~~ gradually

J. then cyed with heating of it
and let ~~it~~ other end cool
marked downward and N upward

The end that turned south was attracted by the north pole of the magnet and attracted the north point of an Eyed needle and that End that turned north was attracted by the south pole of the magnet & attracted the south pole of the Eyed needle

7 Sept 1697

If a man strike along the pole of the magnet by the approach of the end of the needle it will put that needle into a vertigo motion which motion may be the most easy of the magnet which is by the vanity imagination or attraction of the magnet upon the needle:

An iron rod 2 foot long exactly & under on five inches so that it will be in an equipendium: when heated red hott and soft tempered slowly upon hot coals will grow cold:

1 The cold bottom first & bottom and about the upper end coldest longest

2 The end next the grand contracts a small vertigo and attracts the South end of a magnetical needle

3 I could observe but little or no variation that where east was at first

4 heat again and the other end placed upon needle & vertigo changed: and the colder end inverts not:

5 A rod suspended in a groove which no fire now it stood meridionally but a fire & rod made in the form the ends & had a right bottomed figure five inches towards the fire

where whether by the attraction of the
Sun through the Summit of the
very attraction of the Sun or of the
Subsequent Sun Summer And above Sum
the Sea could compensable

vide Newton pag 429 the variation
of the variation by the Moon
of Novemb

If so the inner collision of Sun
and the Effluvia would
and so cause a ~~vibration~~ more
terrible ~~orbic~~ disturbation
the other 13

a movable stone will and ~~Sufficient~~ a
good magnet an armed will not
sufficient so great a weight of Iron
as when armed But yet the movable
or unarmed stone will give as vigorous
and Effective velocity as the strong
or armed stone Get Lost

Is - nerpendicular to the Equinoctial North
& at the N Equator the pond that
was rounder the north and
well when first drawn in the
south and would be attracted
by the weaker pole of the stone

~~Lowsbai~~ Vnar 477

The victory of an armed may not forbid
Egressdmgo the unarmed but the vitlest
Majesty not greater power say lofs than
unarmed
both gave an Equal weakness be a Lofsman
armed if Covered with paper will
attract no more than if unarmed

Statica

64
32
16
8
4
2
1
1

128

)128(10
12.
08

10 ℔ oz Troy

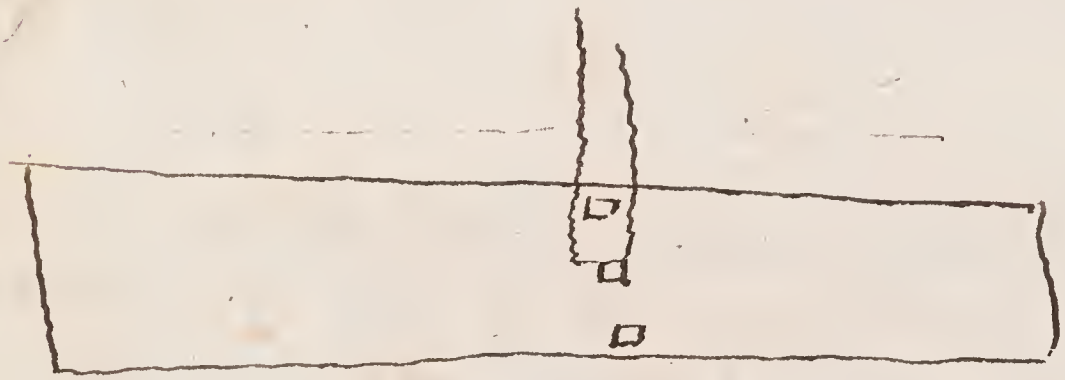
)128(8
128

8 avordupoys

3 - ½

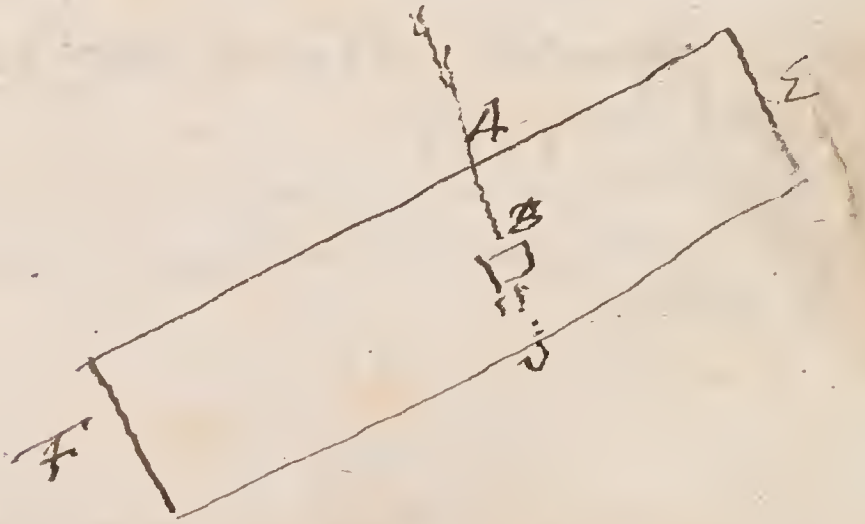
11 ℔ ½

My great Brasile block weighed 11 ½ avordupoys
was 2 foots Lange six myer Broad
and 2 myer three and accordingly
rounded.



The block standing perpendicular to the horizon viz the handle at any position would stand in Equilibrio

through removed from its Center
to the horizon yet at the uppermost
hole it would still remain at Golgotha
its horizontall Equilibration &
the reason is by reason through one
end turns it had no disparity of
weight at either arme



The line would bee when in the
middle hole where was the center of
Gravity of the Globe and the reason
is still the same for though the pressure
under has cast more of the upper
side of the Globe towards ~~C~~ E
yet the weight E & C yet c d the lower

my great leadstone weighed six
ounces and a half wanting half a
quarter
viz 6 ounces one quarter and a half
quarter

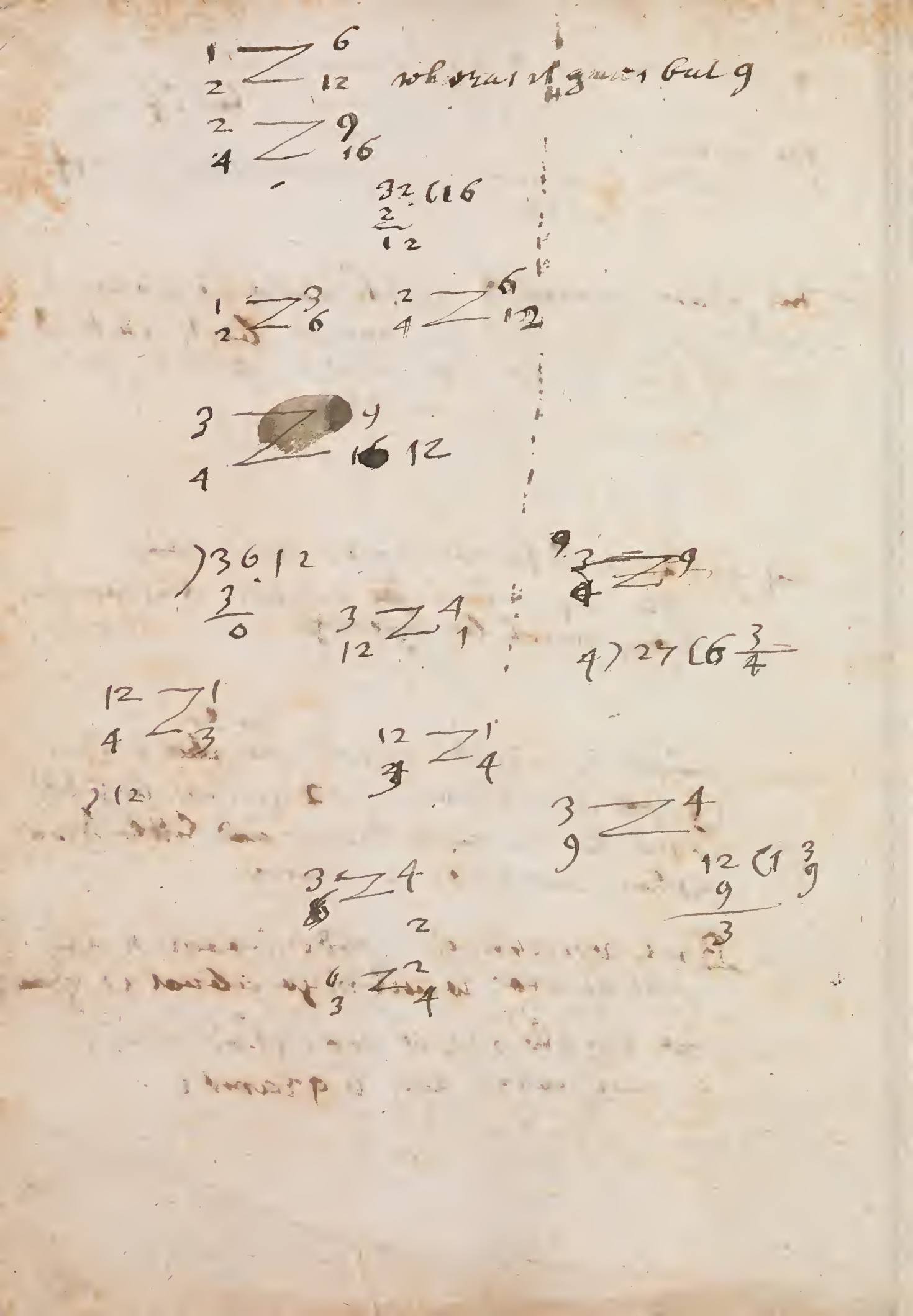
— his stone armed with steel would
take up one and 12 pound but naked
would not take up much above half
an ounce and half a quarter

my great leadstone armed new wor
take up about 40 ounces it is reached
very much by lightning

my small leadstone armed holds
13 ounces viz 12 ounces besides
the grate and screw and ~~little~~ iron
~~other weight~~ 2 ounces

But unarmed holds about half
an ounce wanting about 12 grains

The single stone weighed half
an ounce and 6 grains



The generall Gallonage
one ounce at 12 Counter poyseth at

at one 28 ounces $\frac{1}{2}$ ounce $\frac{1}{8}$ vntie
at two 13 ounces $\frac{1}{2}$ vntie & somewhat more
at three 8 ounces $\frac{1}{2}$ vntie
at fowre 6 ounces
at fyue 4 ounces $\frac{1}{2}$ ounce 5 grames
at six 3 ounces $\frac{1}{2}$ vntie 5 grames
at seuen 2 ounces $\frac{1}{2}$ ounce $\frac{1}{4}$ ounce 15 grames
at Eight 2 ounces $\frac{1}{4}$ vntie 4 grames
at nyne 2 ounces wanting $\frac{1}{8}$ of an ounce.
at ten one ounce $\frac{1}{2}$ vntie
at Eleuen one ounce & $\frac{1}{4}$ vntie wanting 5 grames

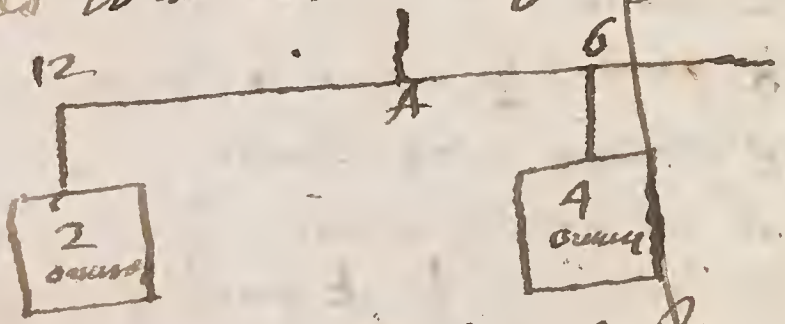
Byrall in small weights In this proportion
is not so distante yf I put in the scales
at 12. fowre ounces but at Counterpaise at

Two 31 ounces $\frac{1}{2}$ ounce & $\frac{1}{4}$ vntie:
Three 20 ounces $\frac{1}{2}$ ounce
Fowre 15 ounces & 1 Dram
Fyue 10 ounces $\frac{1}{2}$ & an ounce $\frac{1}{4}$ vntie
six 8 ounces $\frac{1}{2}$ ounce 1 Dram:
seuen 8 ounces very neare
Eight 6 ounces $\frac{1}{2}$ vntie $\frac{1}{4}$ ounce
nyne 5 ounces $\frac{1}{2}$ & ounce $\frac{1}{4}$ vntie $\frac{1}{8}$ vntie

2 ounces at 12 Centesimal at

of Two	12	ounce $\frac{1}{2}$ unce
Three	12	ounces $\frac{1}{2}$ unce
Fower	9	ounces
Fine	7	ounces
Six	5	ounces $\frac{1}{2}$ unce $\frac{1}{4}$ unce
Seven	4	ounces $\frac{1}{2}$ unce
Eight	3	ounces $\frac{1}{2}$ ounce $\frac{1}{4}$ unce 1 Dram
Nyne	3	ounces $\frac{1}{4}$ unce
Ten	2	ounces $\frac{1}{2}$ unce $\frac{1}{4}$

The rule of Statiqes is that in a plaine scale whose barre is parralel to the horizon such as is the proportion of the longer distance from the center of the scale to the shorter distance such is the proportion of weight appended at the extreme of the shorter distance to the weight appended at the extremity of the longer distance with in a rule of proportion Equiponderated



Therefor 2 ounces at the distance 12 will Equiponderate 4 ounces at 6
Form a Rule of proportion as 12 is to 6
so the distance 4 is to two ounces

the weight 12 — 6 6 — 12
9 — 2 2 — 4

~~And apart~~
If 12 ds 12 is to 6 so yard of distance
so is 4 the lesser weight to 4 the greater
weight multiply 1no by 12 and double
it by 6 or multiply 4 ye greater weight
by six ye less distance & double ye 12
by 12 ye greater distance the product is 2
for as 12 ~~is to six~~ six ye lesser distance
is to 12 ~~ye greater~~ distance so is a ~~certain~~
proportion ~~to the~~ 2 ~~the~~ lesser weight at
12 is proportionable to 4 ye greater weight
at 6 the lesser distance

But in experiment upon the Ballance
Scale: I finde it not so nor uniforme
For
one ounce at 12 Equipunderates
3 ounces and more at 6
Two ounces at 12 Equiponderates
five ounces and more at six
Four ounces at 12 counterpoyseth
Eight ounces ½ at six

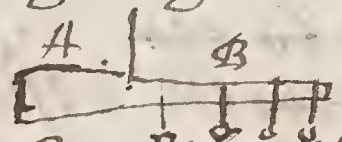
The greater weights bringes it indeed
nearer ye geometrical proportion of ye
staliges but yet it is not Exact
Eight ounces at 12 is Counterpoyzed
by 17 ounces ½ at 6 ~~at~~ whereas
according to the mathematical rule
it should bee but 16

note the reason
of the mistake
was because I
did not the weight
of the scale ought to have been added

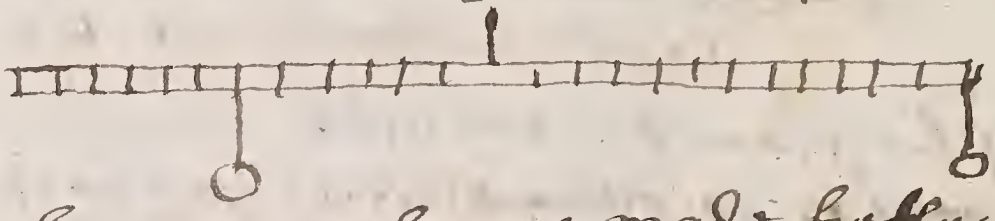
and shorter is former the Roman stator
ar[illegible] is formed upon the supposition of the
proportion between weight and distance
in very fallatious in practice:

1 Because practically the proportion holds
not true.

2 Because the very fabrique of the scale
it self resisting of a shorter radius
cumbers it sings the longer without any
addition of weight adventitious weight
as in the figure seemes necessary to denote



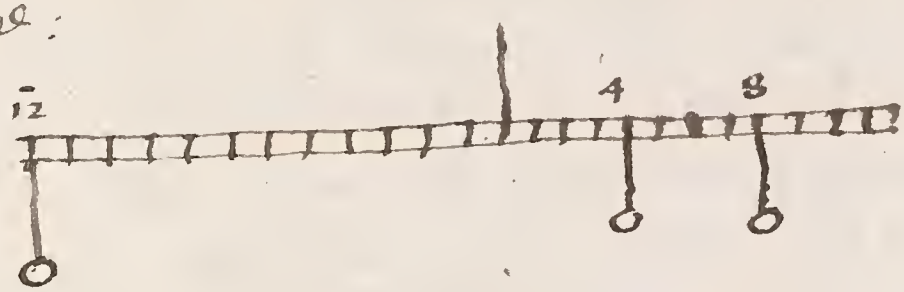
in as much as the shorter radius A is
shorter then the Radius B the disproportion
of the distance gives a variety in the
very weights of the opposite scale B
And therefor in those Experiments I
have chosen a beame of Equall bent
and Equall parts and as neare as
possible every portion of the Earth
division of the beame to have
an Equall weight and hange the weights
at those various distances upon the
scales as in the figure



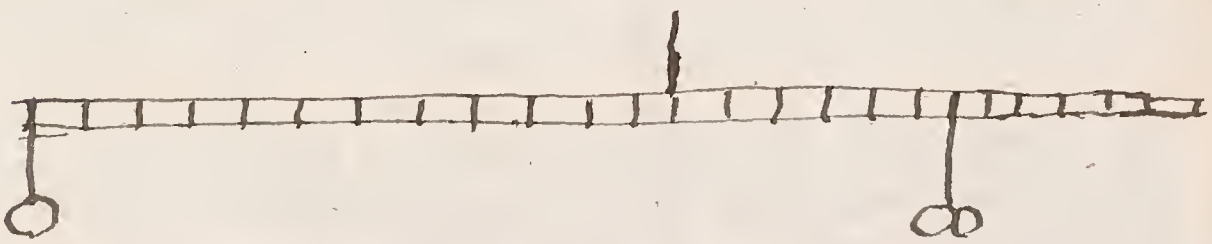
the beame being made hollow
devided in on Earth radius into 12 Equal
parts and pins placed in the hollow
of the beame to at Equal distances to
hange the weights upon

Further ye Composition of weights those things I finde practically true as well as in the theory

1 That if a weight hanged at ye extremity of the Scale at 12 doe counterpoise on the contrary radius by two weights hanged at equal distance as at 4 & 8 the same weight placed in the middle between 4 and 8 viz at 6 will hold ye same Counterpoyse:



on counter at 12 counterpoiseth 1 ounce at 4 and one ounce at 8 this is practically true



the same counterpoise will hold between one ounce at 12 and 2 ounces at 6 in the opposite radius:

Caput 1m

of the proportion of Sonral Weights at Sonral distances

The rule holds true both mechanically and geometrically

As the distance from Centre of the Ballance is to the distance so the weight is to the weight in a reversed rule of proportion

Therfor if an ounce be hanged at the greatest distance viz 12 I would know what weight will Counterpoyse that weight at 3

As 12 is the greatest distance is to three the lesser distance so is the weight of one ounce at 12 to the number sought

12 — 3
1 — 4

And Generally as the greater distance is to the weight applyed to it so is the lesser distance to the weight sought in a Reverse proportion

Therfor 12 — 1
3 — 4

multiplying the first number by the second & dividing by the 3d

So if the proportion be sought at the weight at 4 the number 64

12 — 4 or at 12 — 1
1 — 3 4 — 3

so as the number 6

12 — 6

1 — 2

or as by the rule of proportion

as the greater distance 12 is

to the less weight upon the

1 will so is the smaller

distance 4 to the weight of 4

12 — 1

6 — 2

onto 12 is 12 doubled by 6 is 2:

the like at eight

12 — 1 4

8 — 1 12.

wit and unto

of 3d 8th of

an answer:

This is the rule for the finding of

the weight of the shorter distance

by the known weight & distance

of the greater

so by the known weight and

distance less to find the weight

or distance of the greater

distance weight

3 — 4

12 — 1

as at three the lesser distance

is to four the weight of that

distance so is 12 the greater

distance to the weight required

by the rule of 3 compound multiplying the first number by the 2d & dividing it by the 3d:

So againe if power the lesse distance 4 & 3 its weight then be greater distance 12 giue it weight owne

4 — 3
12 — 1

4/8 = 2/3

Cap 2
In compound weights howe to proued:

As suppose an ounce at 12 counterpoyseth 3 ounces at 4 wch be aduerse reading then I finde by the rule of proportion power that at the distance Eight ounce ounces 1/3 counterpoiseth an ounce at 12 for as 4 gts is to 3 ounces so 8 gts is to 2 ounces 1 & 1/3 answere: in a power proportion

If 2 weights bee appended vpon the same leuer at seuerall distances if the distance betweene those two positions bee so deuided in proportion as the greater weight beares to the lesser those two weights appended vpon that point shall weigh as much as the 2 weights in seuerall distances

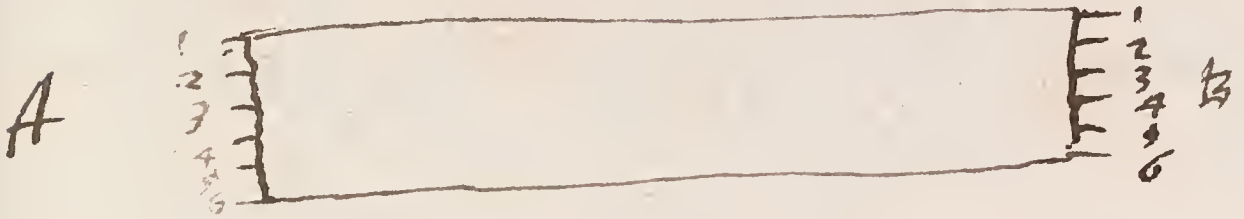
For instance
suppose the weight of 2 ounces imployed
at 2d distance 2 and the weight of an
ounce 8 so imployed at 8 those
two weights thus disposed Counterpoyse
one ounce in the opposite radius at 12
for the distance between 2 and 8 so
doubled is such proportion as two the
greater weight bears to one ounce so
lesser weight that division will fall
at 4 for as 2 the greater weight is
to one the lesser weight so is 8 the
greater distance to 4

2 — 1
8 — 4 viz in
a proportion subdupla: for 8 ounces,
lower at ofton as two ounces one
three ounces therefore appended at 4
will Counterpoise one ounce at 12 in the
opposite radius

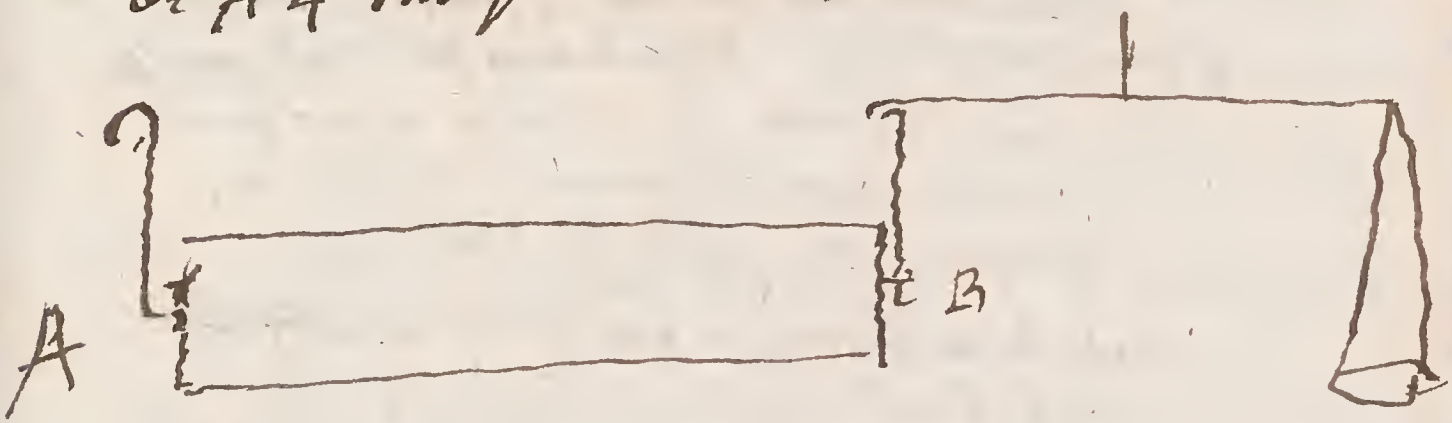
But suppose the greater weight viz
2 ounces two imployed at 2d greater
distance viz 2in: and one ounce
the lesser weight 8 so imployed at
the lesser distance viz 8 and both these
Counterpoyse two ounces in the adverse
radius at 12 or near it (for the exact
Counterpoise of 2 ounces at 12 is one ounce
at 4 & 2 ounces at 10 in the adverse radius)

If 2 equall weights in one radius number
poize an equal weight in one of them on
the opposit radius the middle between
both the 2 weights will make those two
counterveil the weight at greater distance
As if two ounces at E radius A & B applyed
at 12 and Counterpoysed by one ounce
at 4 of the other ounces at 4 upon the
radius B those 2 ounces applyed
at six they and the middle between 4
and 8 they will therefore Counterpoyse
the ounce at 12 in the aboves radius:
and so 1 ounce at 3 and one ounce
at 9 in the scale B will Counterpoyse
one ounce at 12 in the scale A and
consequently at sixt two ounces will
will hold the same Counterpoyse.

my great beame weighes 12 lb 9 oz ½ oz heavier
Sutleys ammunition ye 16 lb 9 oz ½ oz Troy



suspended at one End at A and weighed at E
other end it weighed 90 ounces Exact ounces,
to 7 lb 6 oz or Troyweight besides the scale
weighs about 1 oz
And though suspended at A 1 or A 2 or A 3
or A 4 the great counterpoise holds the same



so that at the scale at B half the weight
of E became it bound with 8 lb Troy and
sometimes more

The South End of the Stones

~~The South End of the~~ Horizontal Rod
~~that turned to the~~ Perpendicular
~~The North end~~ that with the mark
M the Circle yet that end took
up the ~~north~~ End of needle
pointed at the North End

yet touching a single needle
with the North End of the
Horizontal it attracted it and
the Speech and drove it away

Magnetism

That which in my borrella attracts the
the south point of the needle pointing
northward is the smaller circle that
which attracts the south point is that
circle which hath holes in it

In my greate stone that which is
marked for the north pole attracts
the ~~south~~ north point of the needle & E
conuerso:

And so in my lost

In my gold stone that which is marked
with strokes under with attracts the
north

Bugs and Irons $\frac{1}{2}$ of an ounce

my smallest stone armed weighed $\frac{1}{4}$ of an ounce
and borne up armed weighed 2 ounces $\frac{3}{4}$

My next load stone armed $\frac{3}{4}$ of an ounce
weigh
taken up ——— 9 ounces

my borrella weighed armed 3 ounces
taken up only 4 ounces

my biggest armed weighed 9 ounces
taken up 28 ounces $\frac{1}{2}$

The weights were Troy weights
in a burse with an iron plate and hooks

And it been all Iron I suppose it would have done much more by the derivation of the magnetique power through all the body of it

The weather weighed 2 —— 12 ounces 1/4

My 1 peece of load stone

The Same peece at the broken end attracted the north end of the needle at the other the south end

The other peece cut of of it at the broken End attracted the north end of the needle at the other the south end

yet layd upon the square stone the the which changed, a Cross the stone changed its position & the north end turned to the south

My Terrella that draws the north End of the needle hath a breath in the very line of the Circle

Lay the long stone layd with the north to the north diverted the north and turned about forth to the south on

But layd north to south stood still only moved the north pole to the south pole

No 2 Arithmetic:

And for divisor of a number by a divisor of 3 figures or more: Tryal

1st to find how often the first figure of the left hand of the divisor is to be found in the first figure of the dividend:

289) 954 7 (

as 2 in 9 from hand & hymes so the divisor 3 in a mast spare

289) 954 7 (3

289) 954 7 (4 2 4

936

217

289 (1

217 (3

74

2

My groate & little stone marked north attracted the north end of the needle

The south end of my great stone takes up six ounces

The north would not take up 4 ounces

The like proportion in my gold stone

The needle touched at one end with the south at the other end with the north the north pole attracted by the north end of the stone that touched at the south with the south end

By Loadstone stone touched with
turned in the dish to the south
yet attracted the north end of
the needle turned with
the north

The Terrella the end with the
Grave turned to the south
but attracts the north end
of the needle turned with
the north

That part of the needle turn
with that part of the stone
that turned to the south
immersed in water with the north
turned to the south north and the
north rose up at that end
above the water & subsided
in the south end through the same
were heavier

But the south end of the
stone attracted the end
of the needle that turned
and the other end drew

away

note the true north End of the Road
is that way Inward to the South

The true north end of my bottle
with a Broark in that ditch
that stands South but the end
bottled with it Inward north East
a small Broark in the Ditch

The ~~north~~ true north Surrange
South of my ~~the~~ gold stone that
a Stone with a fire on the Copp

Note north westerly Cabin

Fractions

1 notation

1 proper when the numerator less than denominator.

2 improper when numerator greater than the denominator:

Such a fraction is an integer & more as $\frac{8}{4}$

2 simple as $\frac{2}{4}$ or

3 Compound with fraction of an a fraction as $\frac{2}{4}$ of $\frac{2}{3}$

Or division if there be any remainder that is the numerator and the divisor the denominator.

3) 20 (6
18
2
$\frac{2}{3}$

Reduction of fractions

improper fraction

divide the numerator by the denominator & the quotient gives the integer and if there be any remainder it is the numerator of the old denominator

$\frac{16}{3}$ divide 16 the numerator by 3 the denominator the quotient result 5 integer and $\frac{1}{3}$.

3) 16 (5
15
1
$\frac{1}{3}$

Reduction of ℔ Fractions

Examples

vulgar methods

1 Prejudice not 2 Equal parts

2 double the numerate by 2
for a new numerate

2 double the denominate
by 2 for a new denominate

$\frac{8}{16}$ 8 doubled by 2 gives 4
16 doubled by 2 gives 8
so that $\frac{8}{16}$ is $\frac{4}{8}$

2 if both ends ℔ or one ending
℔ & the other

Three observable motions in the magnet

1. Attraction which is
   1 in relation to bodys not magnetical
   as Iron not touched:
   2 in relation to bodys magnetical
   1 other magnets
   2 Iron armed with the magnet
   In both the motions
   1 of approach
   2 of retire

2 direction ~~of motion~~ advancing
   direct to meridian & Iron at
   declination
   vertical & Axis of
   Iron Cylinder

3 communicable virtue how made

Farther magnetism

The whole all observations upon the whole matter Especially what this virtue magnetica

what remarkable deviation happens the system of the world the motion or rest of the Earth

The Square Hemisphere weighed
103 oz $\frac{1}{2}$

Wee lb 6 4 ounces $\frac{1}{2}$ avoirdupois
subtracted

$\frac{1}{4}$ ounces out side 6 inches
outside of the hedge 6 inches $\frac{1}{2}$
out side of all 7 inches

64
32
16
8
4
2
1
$\frac{1}{2}$
$\frac{1}{4}$

(6) 116 (

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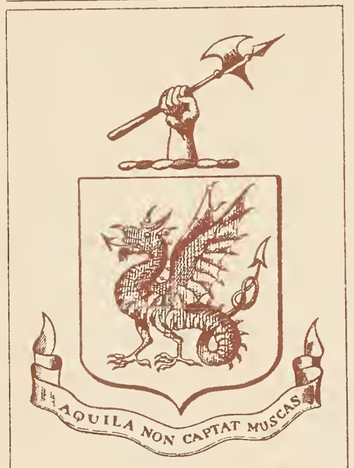

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